Claims

1. Method of management in a circuit-switched communication network (1), the method being performed on, or with the aid of, at least one programmable device (10) connected to said network, characterised by the step of computing (202) and storing (203) in an electronic memory (1018, 1020) a representation of the network based on B-blocking islands (N_i), each B-blocking island consisting of a maximal set of nodes (A-G) linked in a such a way that at least one route with at least an amount B of concave resources exists between any pair of nodes in the set at the time t.

2. Method according to claim 1, further comprising the step of organising said B_i-blocking islands (N_i) in a hierarchy, wherein the hierarchical position of each B_i-blocking island depends on the choice of the value B_i used for defining said blocking island.

3. Method according to claim 2, wherein said values B_i used for defining the blocking island hierarchy are predefined according to common resources requirements.

4. Method according to claim 3, further comprising the step of changing dynamically said values B_i used for defining the blocking island hierarchy.

5. Method according to one of the ~~claims 2 to 4~~ claim 2, further comprising the step of dynamically merging at least one hierarchical level two B-blocking islands when deallocation of an established circuit in said network (1) has freed enough resources on a link (l_i) between said two B-blocking islands (N_i) such that at least an amount B of resources is available on said link (l_i).

6. Method according to one of the ~~claims 2 to 5~~ claim 2, further comprising the step of dynamically splitting at at least one hierarchical level a B-blocking island (N_i) when establishment of a new circuit using at least one link between two nodes inside said B-blocking island uses too many resources to allow a

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route with at least an amount B of resources between any pair of nodes inside said B-blocking island.

7. Method according to one of the ~~claims 2 to 6~~ claim 2, further comprising the step of updating said B-blocking island hierarchy in the case of rerouting of demands, link failure or link removal, alteration of the properties of a link, adding of a link, node failure, node removal or node addition.

8. Method according to one of the ~~claims 1 to 7~~ claim 1, said method being used for finding a path between at least two nodes (A-G) in a circuit-switched communication network (1) with at least an amount b of resources available, the search of said path being confined to a B-blocking island comprising at least two said nodes, and B being bigger than b.

9. Method according to claim 8, further comprising the step of selecting the most suitable path by analysing the impact each path has on the structure of blocking islands hierarchy.

10. Method according to claim 8 ~~or 9~~, further comprising the step of selecting the most suitable path by comparing at which level of the B-blocking island hierarchy each route appears.

11. Method according to the claim 8 ~~or 9~~, wherein the search space for a demand of the routing algorithm is reduced to the subnetwork summarised by the B-blocking island with the greatest predefined B that contains the endpoints of said demand.

12. Method according to ~~one of the claims 2 to 7~~ claim 2, said method being used for rerouting connections that use more critical links at level B_i of the hierarchy than necessary (zig-zag connections).

13. Method according to ~~one of the claims 2 to 7~~ claim 2, said method being used for determining the price of a communication, said price being dependent at least partially on the hierarchical level of the links (l_i) used by the circuit established for the communication in said hierarchy of B-blocking islands.

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14. Method according to ~~one of the claims 2 to 7~~ claim 2, said method being used for analysing the behaviour of an existing circuit-switched communication network or planning the construction of a new circuit-switched communication network or the modification of an existing circuit-switched communication network.

15. Method according to one of the ~~claims 1 to 7~~ claim 1, said method being based on a hierarchy of autonomous intelligent agents, each agent being responsible for a set of nodes in said circuit-switched communication network, higher level agents arbitrating conflicts between peer agents, each agent being responsible for a dynamically defined set of nodes (N_i) consisting of nodes linked in a such a way that at least a route with at least an amount B of concave resources exist between any pair of nodes in the set at the time t, and the level of the agents in said hierarchy being dependent on the choice of the value B used for defining said set of nodes.

16. Method according to claim 15, said method being used for routing demands between at least two nodes in a circuit-switched communication network (1), and comprising the following steps undertaken when a new demand arises issued by a network node x which needs to communicate with at least one other node y, an amount B of resources being requested for that communication:

first the node x asks the agent responsible for the node x with the lowest level in the hierarchy of agents to establish a circuit for said new demand,

said agent passes on this demand to the agent at the next level in the hierarchy,

until the agent at the level B is reached, which then finds a route between x and y and establishes the circuit.

17. Method according to claim 15, said method being used for determining the price of a communication, said price being dependent at least

partially on the hierarchical level of the links (l_i) used by the circuit established for the communication in said hierarchy of blocking islands.

18. Method according to ~~one of the claims 1 to 17~~ claim 1, wherein said resource used for determining the nodes belonging to the same B-blocking island is the bandwidth.

19. Method according to ~~one of the claims 1 to 18~~ claim 1, performed on a central hardware and software management platform (10).

20. Method according to ~~one of the claims 1 to 18~~ claim 1, performed by distributed communication and/or terminal nodes in the network.

21. Method according to ~~one of the claims 1 to 20~~ claim 1, wherein said circuit-switched communication network (1) is an ATM network.

22. Method according to claim 21, said method being used for a connection admission control function (CAC) in an ATM switch (10), the routing module of the connection admission control employing a blocking island hierarchy.

23. Method according to ~~one of the claims 1 to 20~~ claim 1, wherein said circuit-switched communication network (1) is a SDH network.

24. Method according to ~~one of the claims 1 to 20~~ claim 1, wherein said circuit-switched communication network (1) is a RSVP and TCP/IP network.

25. Method according to ~~one of the claims 1 to 20~~ claim 1, wherein said circuit-switched communication network (1) is a TDM network.

26. Device (10) which can be used as a terminal node or as a communication node in a circuit-switched communication network (1), characterised by means (1016, 1018, 1020) for computing a representation of the network based on B-blocking islands (N_i), each B-blocking island consisting of a maximal set of concave nodes linked in a such a way that at least one

route with at least an amount B of resources exists between any pair of nodes in the set at the time t, and storing means (1018, 1020) for storing said representation.

27. Device according to claim 26, further comprising means for organising said B-blocking islands (N_i) in a hierarchy, wherein the hierarchical position of each B_i-blocking island depends on the choice of the value B_i used for defining said blocking island.

28. Device according to claim 27, wherein said values Bi used for defining the blocking island hierarchy are predefined according to common resources requirements.

29. Device according to claim 28, further comprising means for dynamically changing said values B_i used for defining the blocking island hierarchy.

30. Device according to ~~one of the claims 26 to 29~~ claim 26, further comprising means for dynamically merging at least one hierarchical level two B-blocking islands (N_i) when deallocation of an established circuit in said network has freed enough resources on a link (l_i) between said two B-blocking islands such that at least an amount B of resources is available on said link (l_i).

31. Device according to ~~one of the claims 26 to 29~~ claim 26, further comprising means for dynamically splitting at least one hierarchical level a B-blocking island when establishment of a new circuit using at least one link between two nodes inside said B-blocking island uses too many resources to allow a route with at least an amount B of resources between any pair of nodes inside said B-blocking island.

32. Device according to ~~one of the claims 26 to 31~~ claim 26, further comprising means for updating said B-blocking island hierarchy in the case of rerouting of demands, link failure or link removal, alteration of the properties of a link, adding of a link, node failure, node removal or node addition.

33. Device according to claim 26 ~~one of the claims 26 to 32~~, further comprising routing means for finding a path between at least two nodes (A-G) in said circuit-switched communication network (1) with at least an amount b of resources available, wherein said routing means use said storing means to confine the search of said path to a B-blocking island comprising at least two said nodes, B being bigger than b.

34. Device according to claim 33, further comprising means for selecting the most suitable path by analysing the impact each path has on the structure of the blocking islands hierarchy.

35. Device according to claim 33 ~~or 34~~, further comprising means for selecting the most suitable path by comparing at which level of the B-blocking island hierarchy each route appears.

36. Device according to the claim 33 ~~to 35~~, further comprising means for reducing the search space for a demand of the routing algorithm to the subnetwork summarised by the B-blocking island with the greatest predefined B that contains the endpoints of said demand.

37. Device according to claim 26 ~~one of the claims 26 to 32~~, said device being a price determination device used for determining the price of a communication, wherein said price depends at least partially on the hierarchical level of the links (l_i) used by the circuit established for the communication in said hierarchy of blocking islands.

38. Device according to claim 26 ~~one of the claims 26 to 32~~, said device being a network planning tool that can be used for analysing the behaviour of an existing circuit-switched communication network or planning the construction of a new circuit-switched communication network and the modification of an existing circuit-switched communication network.

39. Device according to claim 26 ~~one of the claims 26 to 38~~, further comprising means (1021) to connect it to said circuit-switched communication network (1).

40. Device according to claim 39, being a central hardware and software management platform in a circuit-switched communication network (1).

41. Device according to claim 39, being a local terminal or communication node in a circuit-switched communication network (1) with distributed management.

42. Device according to claim 41, wherein said distributed management is based on a hierarchy of autonomous intelligent agents, each agent being implemented in a local master node responsible for a dynamically defined set of nodes in said circuit-switched communication network, wherein higher level agents arbitrate conflicts between peer agents, each agent being responsible for a dynamically defined set of nodes (N_i) consisting of nodes linked in a such a way that at least a route with at least an amount B of concave resources exist between any pair of nodes in the set at the time t, and in that the level of each agent in said hierarchy depends on the choice of the value B used for defining said set of nodes.

43. Device according to ~~one of the claims 26 to 42~~ claim 26, wherein said circuit-switched communication network (1) is an ATM-network.

44. Device according to ~~one of the claims 26 to 42~~ claim 26, wherein said circuit-switched communication network (1) is a SDH network.

45. Device according to ~~one of the claims 26 to 42~~ claim 26, wherein said circuit-switched communication network (1) is a RSVP and TCP/IP network.

46. Device according to ~~one of the claims 26 to 42~~ claim 26, wherein said circuit-switched communication network (1) is a TDM network.

47. Device according to ~~one of the claims 26 to 46~~ claim 26, wherein said resource used for determining the nodes belonging to the same B-blocking island is the bandwidth.

48. Planning method for circuit-switched communication network (1), the method being performed on or with the aid of at least a programmable device (101) storing a representation of said network, characterised by the step of computing and storing in an electronic memory (1018, 1020) a representation of the network (1) based on B-blocking islands (Ni), each B-blocking island consisting of a maximal set of nodes linked in a such a way that at least a route with at least an amount B of concave resources exist between any pair of nodes in the set.

49. Planning method according to claim 48, further comprising the step of organising said B-blocking islands in a hierarchy, wherein the hierarchical position of each B-blocking island depends on the choice of the value B used for defining said B-blocking island.

50. Planning method according to ~~one of the claims 48 or 49~~ claim 48, further comprising the step of graphically displaying on a display (1014) connected to said programmable device (101) a summarised representation of said network.

51. Planning method according to claim 50, further comprising the step of graphically highlighting on said display (1014) critical links between said blocking islands.

52. Network planning tool (101) that can be used for analysing the behaviour of an existing circuit-switched communication network (1) and/or for planning modification of an existing network, said network planning tool comprising :

processing means (1016),

storing means (1018, 1020)

display means (1014),

program code means for causing said processing means (1016) to compute, from a representation of the topology of the network and from a set of

demands, a summarised representation of the state of said network at a time t, wherein said summarised representation summarises the available resources by grouping at least some of the nodes of said network into a plurality of B-blocking islands (N_i), each B-blocking island consisting of a set of nodes linked in a such a way that at least one route with at least an amount B of resources exists between any pair of nodes in the set at the time t,

program code means (1011) for causing said processing means (1016) to store in said storing means (1018, 1020) and to display on said display means (1014) said summarised representation.

53. Device (10) which can be used as a terminal node or as a communication node in a circuit-switched communication network (1), characterised by means for computing, storing and updating at least a part of a B-blocking island hierarchy, a said B-blocking island consisting of a maximal set of concave nodes linked in a such a way that at least one route with at least an amount B of resources exists between any pair of nodes in the set at the time t, and the position of each B_i-blocking island in a said B-blocking island hierarchy being dependent on the choice of the value B_i used for defining said blocking island.

54. A program storage device (1011) readable by a programmable apparatus (101) and configured in such a way that it causes said programmable apparatus (101) to perform the method according to ~~one of the claims 1 to 25~~ claim 1.

55. A program storage device (1011) according to claim 54, wherein said programmable apparatus (101) is a device according to ~~one of the claims 26 to 47~~ claim 26.

56. Circuit-switched communication network (1) comprising at least one device (10) according to ~~one of the claims 26 to 47 or 55~~ claim 26.

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57. A program storage device (1011) readable by a computer and configured in such a way that it causes said computer to perform the method according to ~~one of the claims 48 to 51~~ claim 48.

58. A processor readable medium (1011) which is configured in such a way that it causes a programmable device (10) to compute, store and update at least a part of a blocking island hierarchy, a said B-blocking island consisting of a maximal set of concave nodes linked in a such a way that at least one route with at least an amount B of resources exists between any pair of nodes in the set at the time t, and the position of each B_i-blocking island in a said B-blocking island hierarchy being dependent on the choice of the value B_i used for defining said blocking island.

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